

S rial No. 09/914,701
Art Unit: 1742



APPENDIX

1. (Amended) A liquid composition of matter that is suitable as electrolyte for a non-sludging electrolytic zinc phosphate treatment process, said liquid composition comprising water, dissolved phosphoric acid, dissolved nitric acid, dissolved zinc cations, m chemically distinct species of cations other than zinc, and n chemically distinct species of anions other than anions derivable by ionization of phosphoric and nitric acids, each of m and n independently being zero or a positive integer, the concentration of zinc in moles per liter in said liquid composition satisfying the following mathematical condition:

$$\{Zn\} \leq 0.3 \{H_3PO_4\} + 0.5 \{HNO_3\} - 0.5 \sum_{i=0}^m p_i C_i + 0.5 \sum_{j=0}^n q_j A_j$$

in which: “{Zn}”, “{H₃PO₄}”, and “{HNO₃}” respectively represent the zinc, phosphoric acid, and nitric acid concentrations in mol/L; each of C_0 and A_0 is zero; each of p_0 and q_0 is 1; if m is not zero, for each positive integer i from 1 to m , C_i represents the concentration in mol/L of the i th distinct cation species other than zinc present in the bath and p_i represents the cationic valence of said i th distinct cation species; and if n is not zero, for each positive integer j from 1 to n , A_j represents the concentration in mol/L of the j th distinct anion species other than anions derivable by ionization of phosphoric or nitric acids present in the bath and q_j represents the anionic valence of said j th distinct anion species;

- the phosphoric acid concentration is from 0.25 to 0.50 mol/L;

- the nitric acid concentration is from 0.65 to 0.90 mol/L; and

$$\{Zn\} \geq 0.27 \{H_3PO_4\} + 0.45 \{HNO_3\} - 0.45 \sum_{i=0}^m p_i C_i + 0.45 \sum_{j=0}^n q_j A_j$$

12. (Amended) A liquid composition that is suitable as electrolyte for a non-sludging electrolytic zinc phosphate treatment process, said liquid composition comprising water, at least 0.10 mol/L dissolved phosphoric acid, at least 0.3 mol/L [0.10 mol/L] dissolved nitric acid, dissolved zinc cations, m chemically distinct species of cations other than zinc, and n chemically distinct species of anions other than anions derivable by ionization of phosphoric and nitric acids, each of m and n independently being zero or a positive integer, the concentration of zinc in moles per liter in said liquid composition satisfying both of the following mathematical

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conditions:

$$\{Zn\} \leq 0.3 \{H_3PO_4\} + 0.5 \{HNO_3\} - 0.5 \sum_{i=0}^m p_i C_i + 0.5 \sum_{j=0}^n q_j A_j; \text{ and}$$

$$\{Zn\} \geq 0.15 \{H_3PO_4\} + 0.25 \{HNO_3\} - 0.25 \sum_{i=0}^m p_i C_i + 0.25 \sum_{j=0}^n q_j A_j.$$

in which : “{Zn}”, “{H₃PO₄}”, and “{HNO₃}” respectively represent the zinc, phosphoric acid, and nitric acid concentrations in mol/L; each of C₀ and A₀ is zero; each p₀ and q₀ is 1; if *m* is not zero for each positive integer *j* from 1 to *m*, C_{*j*} represents the concentration in mol/L of the *j*th distinct cation species other than zinc present in the bath and *p_j* represents the cationic valence of said *j*th distinct cation species; and if *n* is not zero, for each positive integer *j* from 1 to *n*, A_{*j*} represents the concentration in mol/L of the *j*th distinct anion species other than anions derivable by ionization of phosphoric or nitric acids present in the bath and q_{*j*} represents the anionic valence of said *j*th distinct anion species, wherein {Zn}/{H₃PO₄} < 0.91.